[pra,aps,preprint]revtex4 graphicx section.equation document Quantum Decoherence from Adiabatic Entanglement

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abstract In order to understand quantum decoherence of a quantum system due to its interaction with a large system behaving classically, we introduce the concept of adiabatic quantum entanglement based on the Born-Oppenhemeir approximation. In the adiabatic limit, it is shown that the wave function of the total system formed by the quantum system plus the large system can be factorized as an entangled state with correlation between adiabatic quantum states and quasi-classical motion configurations of the large system. In association with a novel viewpoint about quantum measurement , which has been directly verified by most recent experiments [e.g, S. Durr et.al, Nature 33, 359 (1998)], it is shown that the adiabatic entanglement is indeed responsible for the quantum decoherence and thus it can be regarded as a "clean" quantum measurement when the large system behaves as a classical object. The large system being taken respectively to be a macroscopically distinguishable spatial variable, a high spin system and a harmonic oscillator with a coherent initial state, three illustrations are present with their explicit solutions in this paper.

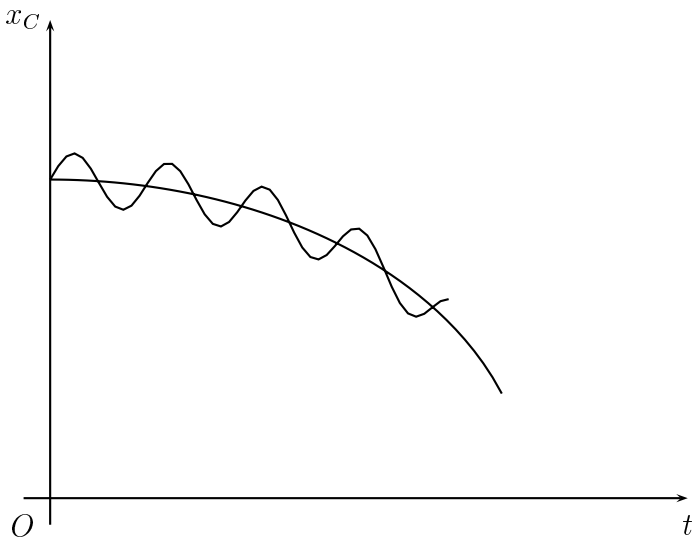

Fig.1:Classical orbit with quantum fluctuation.

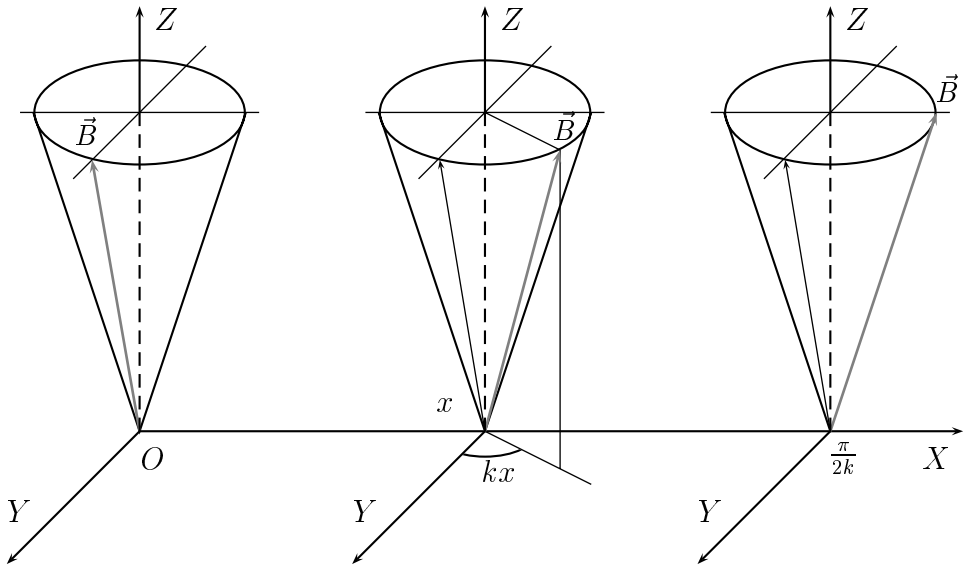

Fig.2:The configuration of a rotating magnectic field for Stern-Gerlach experiment.

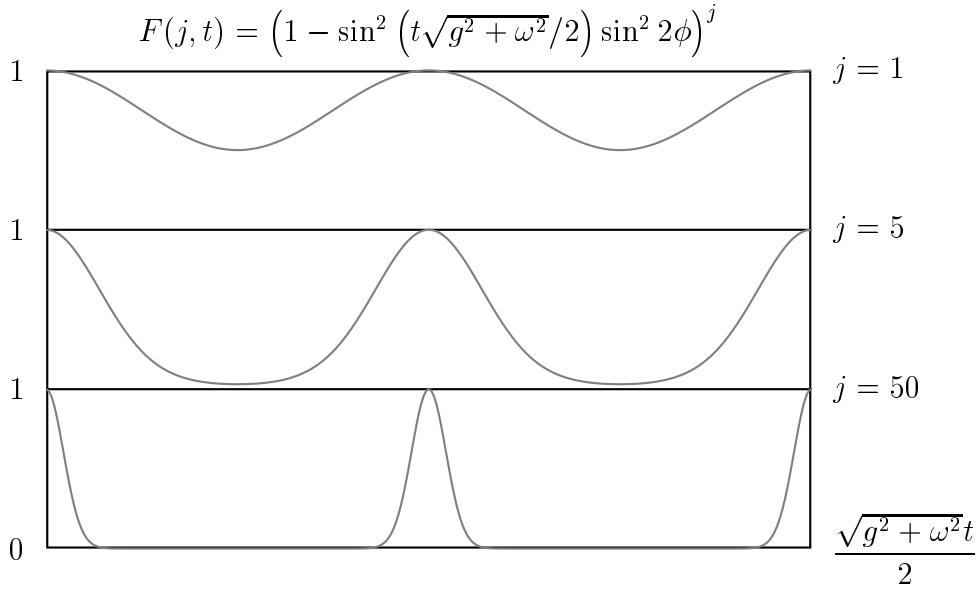

Fig.3:Disappear of non-diagonal elements of density matrix. Here $\sin^2 2\phi = 1/2$**.**

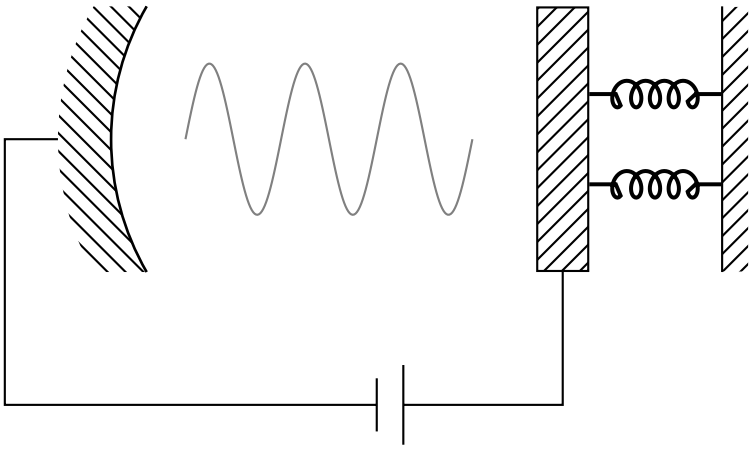

Fig.4: Cavity with a oscillating mirror.